REMARKS

Reconsideration and allowance of the present application are respectfully requested. Claims 8 and 11 have been amended. Claims 2-11 remain pending in the application.

Applicant notes with great appreciation the Examiner's willingness to meet and discuss the present application with Applicant's representative on June 21, 2001.

Figure 3 has been added in response to comments made by the Examiner during the June 21st personal interview. Applicant submits that no new subject matter has been added with the addition of Figure 3.

Claims 2, 8, 9, and 11 were rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,619,505 (Grube et al., hereafter referred to as "Grube") in view of U.S. Patent No. 4,644,534 (Sperlich). Claim 3 was rejected under 35 U.S.C. 103(a) as being unpatentable over Grube and Sperlich, and further in view of U.S. Patent No. 4,144,522 (Kageyama). Claims 4 and 5 were rejected under 35 U.S.C. 103(a) as being unpatentable over Grube and Sperlich, and further in view of U.S. Patent No. U.S. Patent No. 3,798,608 (Huebner). Claims 6 and 10 were rejected under 35 U.S.C. 103(a) as being unpatentable over Grube and Sperlich, and further in view of U.S. Patent No. 5,625,651 (Cioffi). Claim 7 was rejected under 35 U.S.C. 103(a) as being unpatentable over Grube and Sperlich, and further in view of U.S. Patent No. 5,151,896 (Bowman). These rejections are respectfully traversed.

The present invention is directed to the bidirectional transmission of data via a two-wire line, such as two-wire line 100 shown in the examples of Figures 1 and 3. The exemplary transmission of data uses a single two-wire line in a point-to-point fashion

between two stations, such as between a central data station C and a peripheral data station R (specification page 7, lines 4-11). In an exemplary embodiment of the present invention, transmitted data and received data are modulated and demodulated by discrete multitone (DMT) modulation means, and separated by a time division multiplex (TDM) operation. With a TDM operation, a time frame of data transmission is subdivided into a number of time slots, where one direction of data transmission is assigned a great majority of the time slots and the other direction assigned the remainder. In such a system, processing power is directed (e.g., under the control of a TDM unit 30) to either the transmitting or receiving of data at any given time (see, for example, specification page 9, lines 34-39), and the same line attenuation is used in both directions of transmission.

Such features are broadly encompassed by Applicant's claim 8 combination, which recites a method for bidirectional data transmission via a two-wire line comprising, among other features, the steps of transmitting digital data bidirectionally between a first station and a second station via the two-wire line, where only one of a transmitting operation and a receiving operation is performed at any given time in each station, and modulating and demodulating the digital data using discrete multitone modulation and separating digital data to be transmitted and the digital data to be received by time division multiplex operation.

None of the cited documents teach or suggest Applicant's claim 8 combination. Grube discloses a system for producing and recovering an ordered data stream using a DMT transmitter and a DMT receiver. As shown in Figure 9, a communication system 160 performs data transmission in two directions via a twisted pair low pass transmission

path 162 between a primary site 102 and secondary sites 104, 106, and 108 (col. 9, lines 42-46). Due to this configuration, the primary site 102 and each secondary site includes a two-wire to four-wire conversion hybrid (i.e., elements 164, 166, 168, and 170) to split inbound and outbound transmissions (col. 9, lines 46-55). Each conversion hybrid provides echo cancellation and may also include a transformer along with echo cancellation circuitry (col. 9, lines 55-61).

The Grube patent, in contrast to Applicant's claim 8 combination, does not disclose the use of a time division multiplex to separate digital data to be transmitted and digital data to be received on a single two-wire line. In fact, the cited portion of the Grube patent expressly teaches away from this concept, as time-dividing data transmission frames would be completely unnecessary in a system using conversion hybrids and echo cancellation circuitry as disclosed in the Grube patent. For example, the process of splitting data is performed in the Grube patent by two-to-four wire conversion hybrids, whereas in Applicant's claimed invention digital data is separated by time division multiplex operation. As shown in the Figure 1 example, the use of time division multiplexing requires only a transformer 13 to connect the two-wire line 100 to transmitter and receiving sections 50 and 51, as only one of these sections will be in operation at any given time (see, for example, specification page 9, lines 34-39). In contrast, the Grube patent, which does not utilize time division multiplexing, uses two-to-four wire conversion hybrids to connect transmitters and receivers to twisted-pair path 162, thereby providing for simultaneous transmitting and receiving of data, but increasing cost and complexity of the system (see, for example, specification page 6, lines 32-38).

Further, the Grube patent uses echo cancellation to eliminate interfering influences of data transmission on a two-wire line. This method, as discussed on specification pages 1 and 2, is one of the complex and expensive operations that the claimed invention intends to avoid (e.g., echo cancellation requires the use of high resolution A/D convertors and high computing power). In fact, the use of time division multiplex operation precludes interfering crosstalk as an interference source, due to the fact that transmission and reception of digital data are not performed simultaneously, and therefore renders a method such as echo cancellation unnecessary.

The Grube patent therefore fails to teach or suggest Applicant's claim 8 combination.

In order to compensate for Grube's failure to disclose the separation of transmitted data on a single two-wire line using time division multiplex, the Examiner asserts that the teachings of Sperlich would have been an obvious remedy of these deficiencies. The Sperlich patent discloses a TDMA point-to-multipoint communications system, as shown in Figure 1, that includes a central station Z and multiple substations U1-U4. The Sperlich patent is directed to the concept of transmitting multiple signal groups via wireless means to substations U1-U4 (and receiving multiple signals groups from these substations) such that signal delay times due to varying distances between stations are compensated for (abstract, lines 9-30). The Sperlich patent does not disclose or suggest the feature of separating digital data to be transmitted and the digital data to be received by time division multiplex operation, where digital data is bidirectionally transmitted between a first station and a second station via a two-wire line, as recited in Applicant's claim 8 combination. In fact,

the Sperlich patent is not at all directed to point-to-point communication between stations via physical lines, but rather to the different environment of wireless telecommunications. Sperlich therefore fails to overcome deficiencies of the Grube patent with respect to Applicant's claimed invention.

Further, because Grube expressly teaches away from the concept of using a time division multiplex to separate digital data to be transmitted and digital data to be received on a single two-wire line, it would not have been obvious to one of ordinary skill in the art at the time of the invention to combine the teachings of Grube with the teachings of Sperlich, as there would have been no motivation for one to provide time division multiplexing in the Grube system. Only Applicant's specification teaches or suggests such a combination. In response to Examiner's assertion on page 3 that even "without, [sic] Sperlich's teaching, one of ordinary skill in the art would recognize a step of dividing the time slots into transmission and receiving set", Applicant submits that while the general teaching of data stream time division is well-known in the art, the inclusion of such a feature in the Grube would be unnecessary and non-sensical, as discussed above.

For at least these reasons, claim 8 is allowable, and reconsideration and withdrawal of the rejection of claim 8 under 35 U.S.C. 103(a) is requested. Claims 2-7, 9, and 10 depend from independent claim 8 and are patentable at least for the reasons discussed above.

Similarly, applicant's claim 11 combination is allowable, as it recites, among other features, means for transmitting digital data bidirectionally between the first and second stations via the two-wire line, where only one of a transmitting operation and a receiving

operation is performed at any given time in each station, and where each station includes means for modulating and demodulating digital data using discrete multitone modulation, and means for separating digital data to be transmitted and the digital data to be received by time division multiplex operation.

In light of the foregoing, the Applicant has addressed all issues raised in the Office Action and now respectfully submits that the Application is in condition for allowance. Favorable consideration on the merits and prompt allowance are respectfully requested. In the event any questions arise regarding this communication or the application in general, the Examiner is invited to contact Applicant's undersigned representative at the telephone number listed below.

Respectfully submitted,

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Page 6, Paragraph Beginning at Line 12

Other objects and advantages of the present invention will become more apparent from the following detailed description of a preferred embodiment, wherein:

Figure 1 shows a block diagram for the implementation of one embodiment of the method according to the invention; [and]

Figure 2 shows a diagrammatic illustration of a time frame according to the invention; and

Figure 3 shows a simplified block diagram of the exemplary embodiment of Figure 1.

Page 7, Paragraph Beginning at Line 4

In the exemplary embodiment shown in Figure 1, the transmission and reception sections 50, 51 both of a central data station C (CENTRAL) and of a peripheral data station R (REMOTE) are illustrated in a single block diagram, which should be understood such that the central data station C is connected to the data station R via the transformer 13, the two-wire line 100 and a further transformer 13 (the block diagram of Figure 3 illustrates this same configuration in simplified form). Those functional units are associated only with the data station C or R are identified by "ATU-C only" or "ATU-R".

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Page 9, Paragraph Beginning at Line 22

As shown in Figures 1 and 3, the [The] transmission section 50 and the reception section 51 are controlled by a TDM (Time Division Multiplex) unit 30, with the result that, according to the invention, the data to be transmitted and the data to be received are separated by time division multiplex operation, the associated multiplex time frame being subdivided into a predeterminable number N of time slots, and of these a number K of time slots of the time frame being assigned exclusively to one transmission direction, for example transmit, whereas the remaining number N-K of time slots being assigned exclusively to the other transmission direction, for example receive. For this purpose, the TDM unit controls the transmission section 50 and the reception section 51 by activating them at the given time. In this case, the transmission section 50 and the reception section 51 are never in operation at the same time, as a result of which the processor power required for the control can be designed to be correspondingly low. Since influencing of the receiver by its own transmitter is also precluded as a result, only a low resolution is necessary for the analog-to-digital converter 16 of the receiver section. This advantage is highly cost-effective on account of the direct proportionality of resolution and price in the case of analog-to-digital converters.

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Marked-up Claims 8 and 11

8. (Amended) A method for bidirectional data transmission via a two-wire line, comprising the steps of:

transmitting digital data bidirectionally between a first station and a second station via the two-wire line, wherein only one of a transmitting operation and a receiving operation is performed at any given time in each station;

modulating and demodulating the digital data using discrete multitone modulation; and

separating digital data to be transmitted and the digital data to be received by time division multiplex operation, wherein an associated multiplex time frame is subdivided into a predeterminable number of time slots N, a number of time slots K being assigned exclusively to one transmission direction, and the remaining number of time slots N-K being assigned exclusively to the other transmission direction.

11. (Amended) A system for bidirectional data transmission via a single two-wire line, comprising:

[a line transformer;

a transmission section for transmitting a transmission signal to the two-wire line via the line transformer, the transmission section including a discrete multitone modulator for modulating the transmission signal;

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Marked-up Claims 8 and 11

a reception section for receiving a received signal from the two-wire line via the line transformer, the reception section including a discrete multitone demodulator for demodulating the received signal; and

a time division multiplex unit for controlling the transmission and reception sections such that the transmission and reception sections are never operated simultaneously, wherein an associated multiplex time frame is subdivided into a predeterminable number of time slots N, a number of time slots K being assigned exclusively to one transmission direction, and the remaining number of time slots N-K being assigned exclusively to the other transmission direction]

a first station connected to one end of the two-wire line;

a second station connected to the other end of the two-wire line; and

means for transmitting digital data bidirectionally between the first and second stations via the two-wire line, wherein only one of a transmitting operation and a receiving operation is performed at any given time in each station, and wherein each station includes:

means for modulating and demodulating digital data using discrete multitone modulation, and

means for separating digital data to be transmitted and the digital data to be received by time division multiplex operation, wherein an associated multiplex time frame is subdivided into a predeterminable number of time slots N, a number of time slots K being

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assigned exclusively to one transmission direction, and the remaining number of time slots N-K being assigned exclusively to the other transmission direction.